

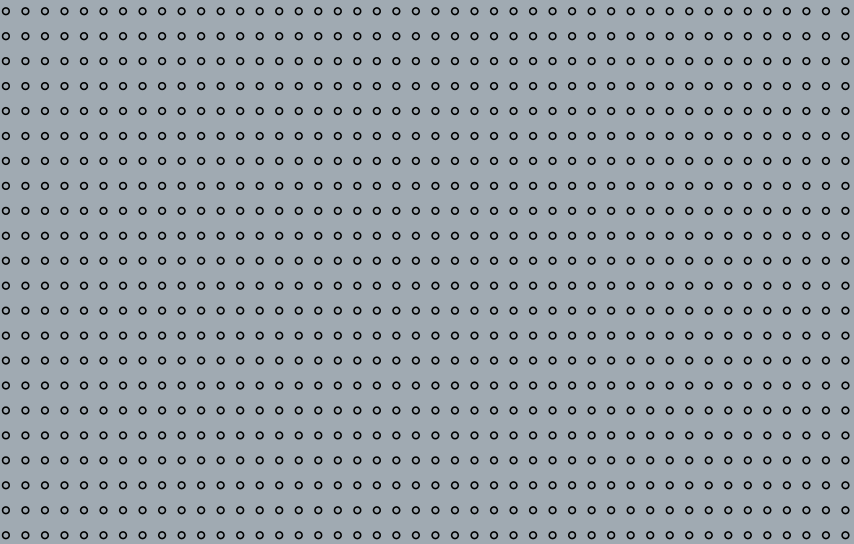


Master the Elements

Manual

Simrad MX525A DGPS Receiver

English



Manual

Simrad MX525A DGPS Receiver

English

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The original language for this document is English. In the event of any discrepancy between translated versions and the English version of this document, the English document will be the official version.

To the best of our knowledge, the content in this publication was correct at the time of printing.

As we are continuously improving our products we retain the right to make changes to the product and the documentation at any time. Updated manuals are available from our website www.simrad-yachting.com, and are free to download.

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IMPORTANT NOTICE!

THE MX525A DGPS RECEIVER IS AN AID TO NAVIGATION ONLY. Under no circumstances should it be used in lieu of authorized government charts. Its accuracy can be affected by many factors such as equipment defects, environmental conditions, or improper operation. The user is responsible for safe navigation of the vessel. This includes consulting authorized government charts and exercising common prudence and navigational judgement at all times.

How to contact us?

Contact your local Simrad dealer for:

- Installation, Service, & Technical Support
- Sales of Accessories
- Hardware and Software Upgrades

Unlike many other consumer electronics industries which only sell consumer electronic devices, your marine dealer is often your best advisor for installation and service of your new GPS receiver. Simrad strongly encourages you to utilize the knowledge and experience of your sales and service dealer.

Should you need to contact us directly for new sales, upgrades, repair service, or technical support, we can be reached at the following:

International:

MX Marine (USA)
A Division of NAVICO, Inc.
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USA
+1 310 791 8213 (Telephone)
+1 310 791 6108 (Fax)
www.mx-marine.com

In Europe:

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Premier Way, Abbey Park
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www.navico.com

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1 General

This manual describes the operation and installation of the MX525A DGPS sensor (with the MGL-4 antenna) and older version MX525 black box DGPS sensor (with the MGL-3 antenna). Their wiring hook-up is identical and the antennas are interchangeable.

The MX525A is a blackbox GPS and Differential Beacon receiver combination. It has a 10-pin connector for power and data connection and a TNC connector to connect to an active GPS and Beacon combo antenna.

When connected to an MX-CDU (MX420 or MX5xx), the MX525A can be controlled to function in several modes, namely;

- GPS only
- DGPS mode in Auto/Database search or Manual
- WAAS (Wide Area Augmentation System-US system)
- EGNOS (European Geostationary Overlay System)
- RAIM (Receiver Autonomous Integrity Monitoring)

This sensor was designed to use as:

- Source of DGPS positioning for any MX CDU model
- Retrofit for IMO compliant GPS and AIS installation
- D/GPS positioning for ECDIS and other charting software

The MX525A can achieve better than 2-meter accuracy in areas with good beacon differential coverage and autonomous GPS accuracy better than 5 meters. The built-in beacon receiver can be operated to do auto-global search, database search or manual mode when connected to the MX CDU.

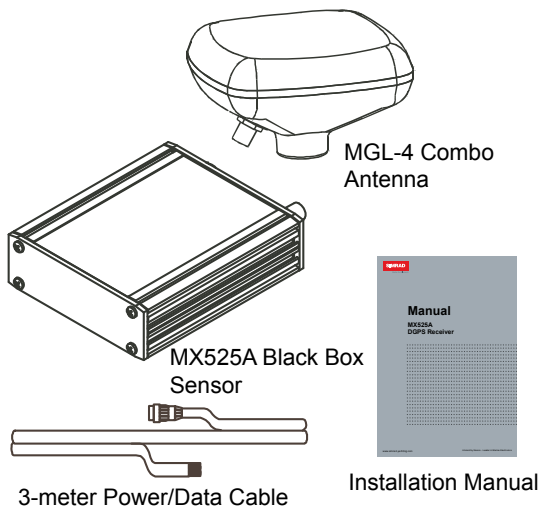
Before installing the MX525A, please read this manual carefully to ensure proper installation and operation of the unit.

Supplied Equipment

The following items are supplied with the MX525A DGPS Sensor Kit (p/n 9525 200 81000):

<u>Description</u>	<u>Part Number</u>
MX525A DGPS Sensor with mounting kit	9525 200 81010
MGL-4 Combo Antenna	721757
Power/Data Cable assembly, 3 m.	3508 102 70150
Installation Manual	727007

The antenna coax cable for the MGL-4 antenna is not included in the kit and must be ordered separately. Several cable lengths are available in stock, please refer to the antenna cable selection section on Page 8 for more details.



MX525A DGPS Sensor Kit

2 Operation

General

The MX525A sensor is an integrated GPS and beacon receiver unit that is fully automatic and requires minimal user intervention. It will automatically search for available satellites as soon as power is applied. The internal 2-channel beacon receiver continuously monitors all beacon signals available in a particular location. The first channel tracks the primary station while the second channel searches for other nearby beacons. Should it find a closer station it will automatically switch the primary channel to the new station. The combined performance of the high-precision 12-channel GPS and 2-channel beacon receiver provides a more accurate position fix, usually within 2 meter or less.

When controlled by an MX CDU, the operator can disable the auto mode and manually select the beacon frequency desired.

The MX525A works with an MGL-4 (or -3) antenna (a combined GPS/H-Field Beacon antenna) for better on-board electrical noise immunity.

Satellite Bases Augmentation System (SBAS)

In areas where land-based beacon stations are not available, the MX525A can be controlled (using the MX CDU) to track the Satellite Based Augmentation Systems (SBAS) like the WASS (US), EGNOS (European), MSAS (Japan) and GAGAN (India) satellites . These satellites transmit DGPS correction data (just like the Coast Guard stations) using the GPS frequency. Refer to the MX CDU Operator Manual for more details. Turning this feature ON in the MX CDU will initiate the MX525A to track any SBAS satellites that are in view. Please be aware that the SBAS system is not an IMO approved differential correction system.

Receiver Autonomous Integrity Monitoring (RAIM)

RAIM is a special software algorithm in the MX525A program which provides another layer of safety because it gives the operator an alarm indication if the GPS system accuracy exceeds a predefined tolerance. This feature requires at least five or more GPS satellites to operate properly. If the position solution falls outside this tolerance (usually 100 meter) a "RAIM Unsafe" alarm will be activated in the MX420 CDU. This means that the accuracy of the position can not be guaranteed at that point in time. The operator is advised to use the GPS for navigation with caution until the RAIM indicator goes back to safe mode (R+).

The RAIM availability is dependent on the number of usable satellites in view. Planned outage of satellites due to maintenance or when certain satellites reach their age of maturity may cause any of the GPS satellites to become unusable. If less than 5 satellites are available a "RAIM Caution" (R?) icon will be displayed. If the GPS system error exceeds 100 meters "RAIM Unsafe" (R-) icon will be displayed. The operator should take cautionary measures during this mode.

3 Installation

MX525A Mounting

The MX525A console is not weather-resistant and must be located inside the equipment room or pilot house where it is dry and protected from the elements. Provide ample clearance around it for good air circulation. Use the supplied mounting bracket kit to mount it on a vertical wall.

Locate the MX525A within 3 meters from the MX CDU junction box. Should there be a need to install the MX525A much farther away from the MX420 CDU, a longer cable assembly can be specially ordered from Simrad.

The MGL-4 antenna is a weather resistant unit and should be mounted in the open location as shown in the antenna location diagram.

Below is a list of power-data cable options available from Simrad:

Part Number	Description
3508 102 70150	3 meter cable
3508 102 70170	20 meter cable
3508 102 70180	40 meter cable
Special order only	80 meter cable

MX525A Connectors

Two connectors are located at the back of the unit, namely:

- Power-Data connector (10-pin male)
- RF (TNC female)

The 10-pin connector provides the means to connect to external power and the data interface. Please refer to the chart below for the pin-outs and wiring color code. The chart also compares the signal interface of the MX525A DGPS sensor against the MX421B-10 smart DGPS antenna. Please note the connection similarities

between them on pins 1 through 8.

The RF (TNC-F) connector is used to connect the MX525A to a combined DGPS antenna (MGL-3).

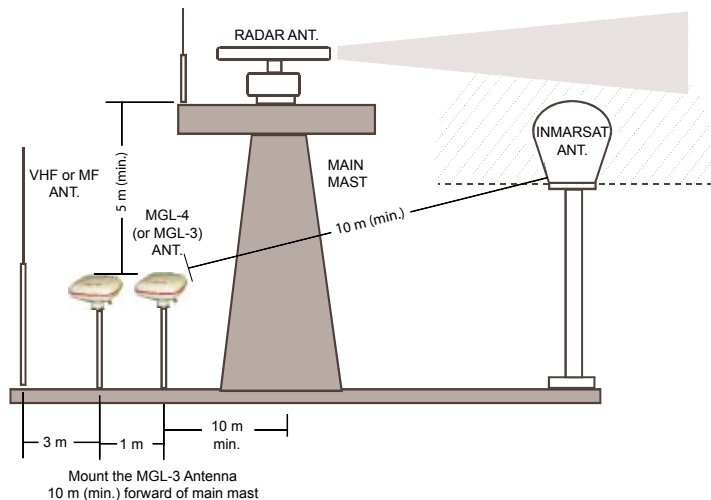
Pin #	Wire Color	Wiring Comparison	
		MX525A	MX421B-10
1	BLK	Negative Ground	
2	RED	+9 - 32 VDC	
3	BLU	MX Proprietary Message (MPM In (-)	
4	BRN	MX Proprietary Message (MPM In (+)	
5	ORG	GPS Out (-)	
6	GRN	GPS Out (+)	
7	YEL	Beacon Status Out (-)	
8	WHT	Beacon Status Out (+)	
9	PRPL	RTCM IN (+)	1 PPS (+)
10	PRPL/ GRY	RTCM IN (-)	1 PPS (-)
TNC	COAX	To MGL-3 Combo Antenna	None

MGL-4 Antenna Mounting Guidelines

- Install the MGL-4 antenna where it has clear view of the sky around it.
- Locate the antenna for easy access and maintenance.
- Stay away from high-power energy sources such as radar, SSB, INMARSAT and other transmitting radio antennas by 5 meters or more.
- Locate the antenna at least 10 feet (about 3 meters) away from and out of the transmitting beam of radar and other high-power transmitters.
- Mount the antenna low to avoid excessive position and speed errors while underway.
- Mount the antenna as far away as possible from large metal structures.



If you are not sure if the chosen antenna location is appropriate, you can mount the MGL-4 antenna temporarily and connect the coax cable to the MX525A. Using the MX CDU, Monitor the GPS signals under the "GPS Status" screen while you move the MGL-4 antenna around.



MGL-4 Antenna location diagram

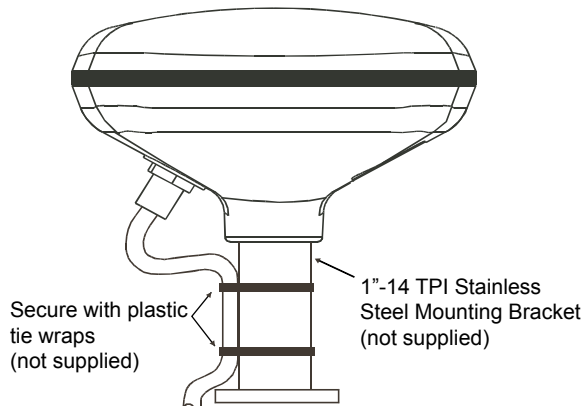
Antenna Mounting

Bracket Mount

The MGL-4 antenna mounting thread is an industry standard fitting for VHF antenna mounting (1.0 inch, 14 TPI). This enables the antenna to be mounted on a wide range of mounting brackets, including the swivel joints, commonly used for angled surface. Refer to the figure below for bracket mounting illustration.



Hand-tighten the antenna onto the bracket until snug. Do not overtighten.



MGL-4 Bracket Mounting

Antenna Cable Selection

The table below gives recommendation on coaxial cables that can be used for the MGL-4 GPS antenna. It is important to keep the attenuation in the cable as low as possible. The maximum allowable cable and connector loss is 15 dB.

Coax cable type	Max cable length (m)	Diameter (mm)	Weight (kg/100m)
RG58	15	5.0	2.6
SAT45	45	5.5	2.6
RG223	25	5.4	5.5
RG214	45	10.8	18.5
LMR400	80	10.3	13.3

The chart below shows the antenna coax cables offered by Simrad:

Part number	Description
3508 100 95780	15 meter, SAT45 cable (TNC-TNC)
3508 100 96010	20 meter, SAT45 cable (TNC-TNC)
3508 100 95910	30 meter, SAT45 cable (TNC-TNC)
3508 100 96020	45 meter, SAT45 cable (TNC-TNC)
Special order	>45 meter, Low-loss, Antenna cable (TNC-TNC)

Power Requirement

External power supplied to the MX525A must be within 9-32 VDC for best operation. To protect the circuitry in the MX525A, the voltage level must be within these limits. Negative grounding is required. The MX525A draws less than 300 mA at 12 VDC. An in-line fuse or circuit breaker rated at 2 amp. is recommended for overload protection.

When the MX525A is connected to an MX CDU, the 12 VDC antenna power is supplied by the CDU unit.

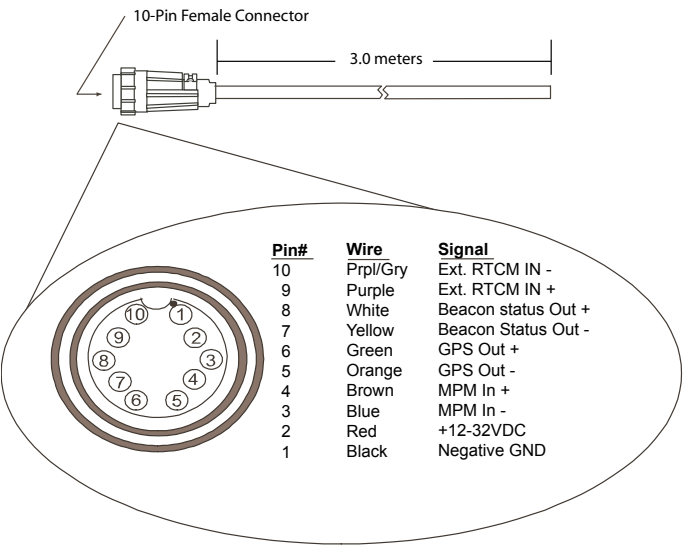
The red wire connects to the (+) DC power, while the black wire is the negative return. Although the MX525A has a reverse polarity protection, it is prudent to make sure that proper polarity is observed before making the connection.



Reverse polarity connection may damage the unit.

Power/Data Cable Assembly

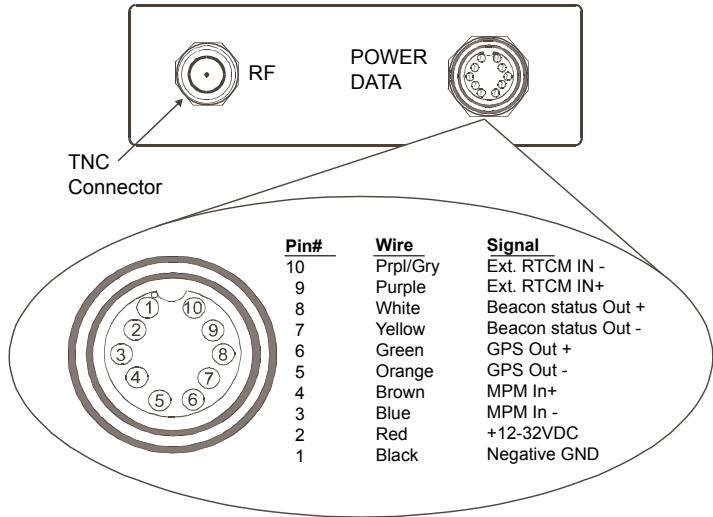
Below is a diagram showing the pins and wire color-coding of the Power/Data cable assembly.



Power/Data Cable Assembly

MX525A Connector Configuration

Refer to the diagram below for the POWER-DATA connector located at the rear panel of the MX525A:



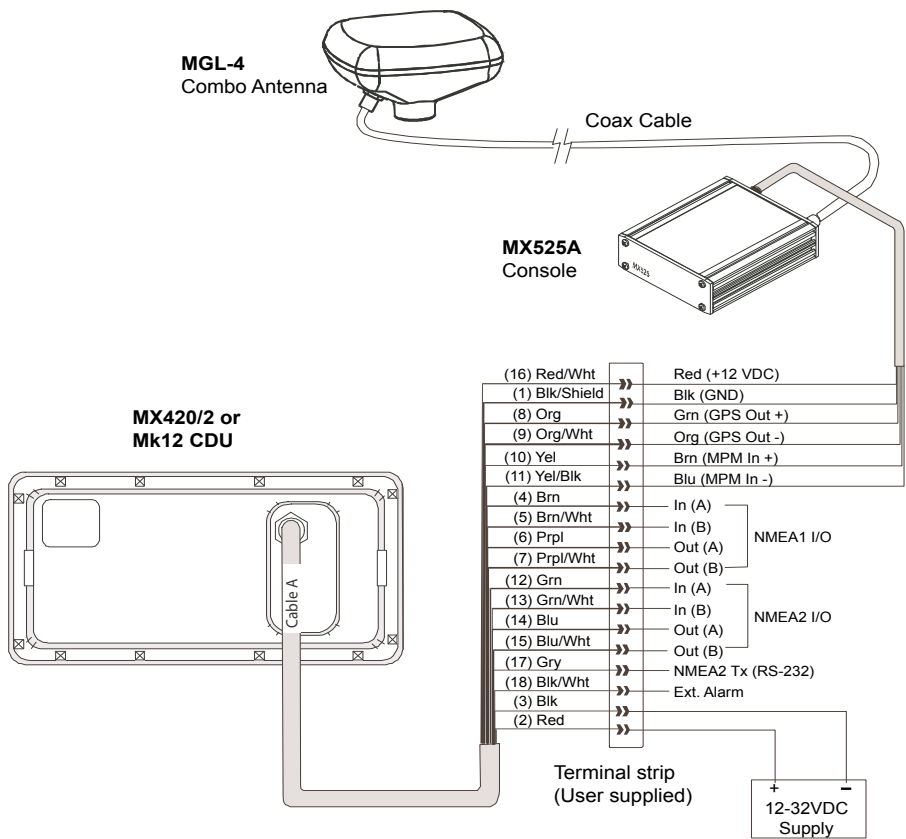
MX525A POWER-DATA Connector

Where:

- Pins 1 & 2: Negative GND and +12 VDC power input.
- Pins 3 & 4: MX proprietary message (MPM) input port.
- Pins 5 & 6: GPS output to the MX420 or other NMEA 0183 compatible devices.
- Pins 7 & 8: Beacon monitoring signal output. Sends the SNR, Signal and Frequency to the MX420/8 CDU. Connects to Cable B of the MX420/8 CDU.
- Pins 9 & 10: External RTCM Correction (Input).

Data Interface to MX420/2 or MK12 CDU

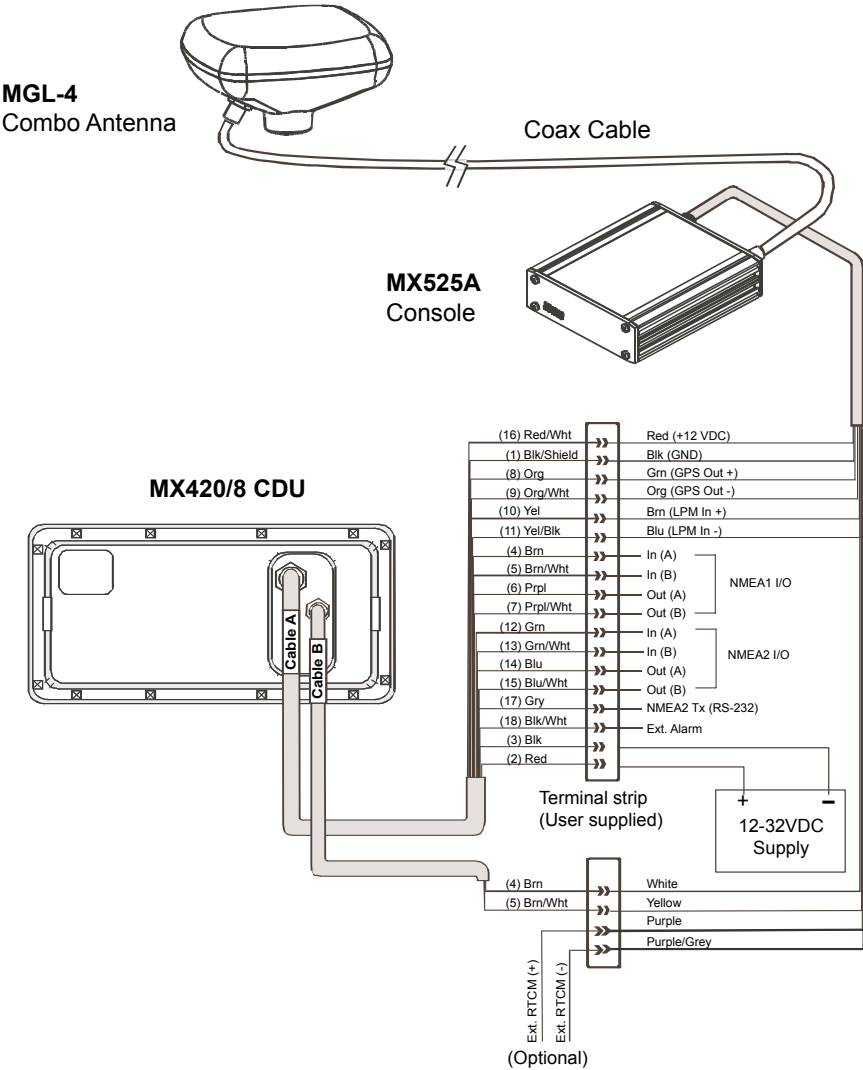
Use the diagram below to interface the MX525A to an MX420/2 or MK12 CDU.



MX525A Interface to MX420/2 or MK12 CDUs

Data Interface to MX420/8 or MX420/AIS CDU

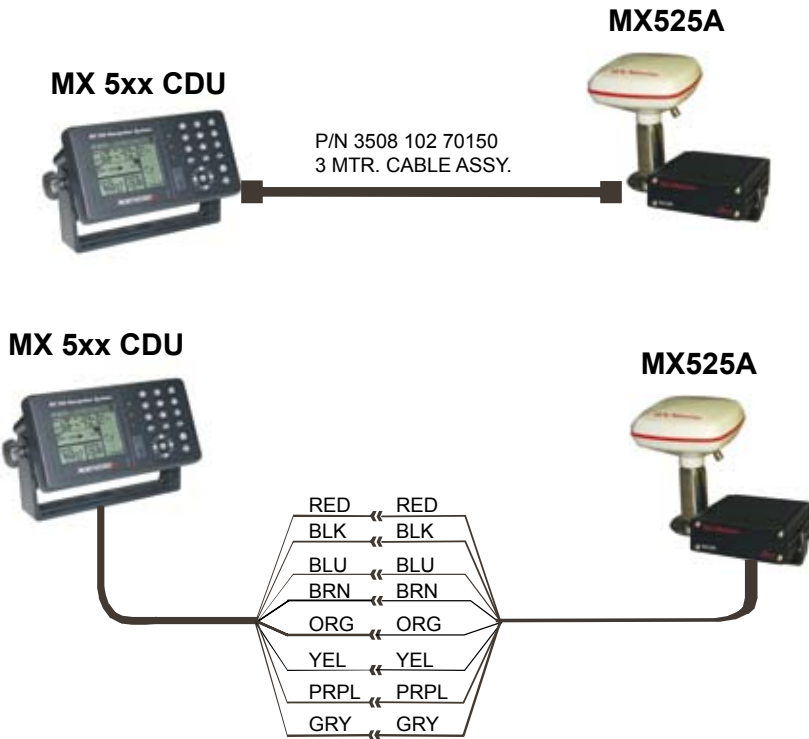
Use the diagram below to interface the MX525A to an MX420/8 or MX420/AIS CDU. The external RTCM connection is optional.



MX525A Interface to MX420/8 or MX420/AIS CDUs

Data Interface to MX5xx CDU

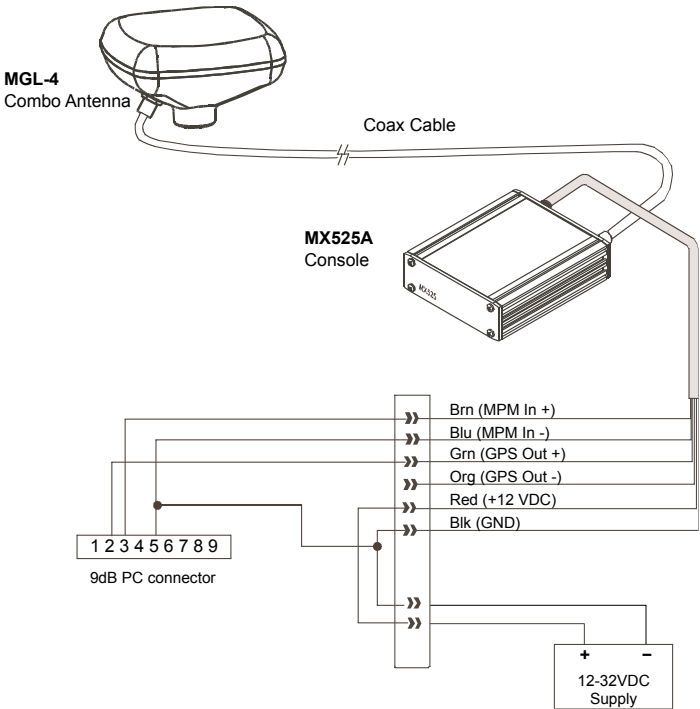
The standard power/data cable (P/N 3508 102 70150) for the MX525A and MX5xx CDU is pre-made with two molded 10-Pin male connectors for an easy plug-and-play connection to the back of the MX5xx CDU. If there is a need to extend (or cut) the standard cable, please refer to the diagram below for the wire splice.



MX525A Interface to MX5xx CDU's

Data Interface to PC or other navigation systems

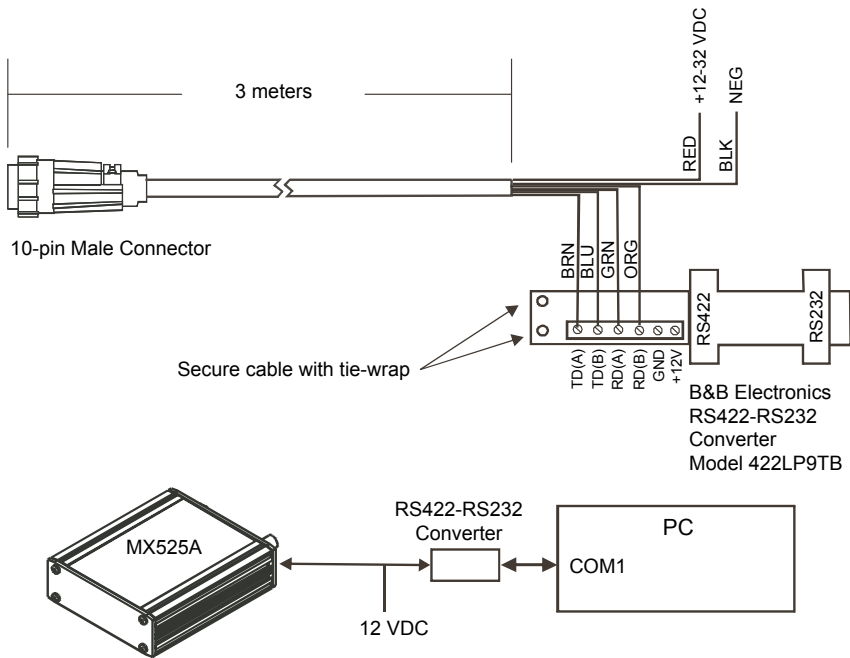
The diagram below shows the power and data output connections to the serial port of a PC or other navigation systems using a dB9 connector and a terminal strip (user



supplied items).
MX525A Interface to other navigation systems

MX525A Programming Cable

The programming cable is used for upgrading the software of the GPS and Beacon PCBs inside the MX525A Console. The diagram below shows the programming cable diagram and equipment setup. Please note that external 12 volt DC is required to power up the MX525A. Connect the red wire to +12 VDC and Black wire to negative GND. The RS422-RS232 converter may be powered from the PC serial port or from an external 12 volt power supply.



MX525A Programming cable diagram

4 Specifications

GPS Receiver

Type: L1, C/A Code (SPS)
1.575 GHz frequency

Channels: 12 Channels, parallel tracking
(10-channel when tracking WAAS/EGNOS/MSAS)

Position Update Rate: 1 Hz (default), 5 Hz (optional)

Position accuracy:

- With differential corrections <2 meters 2D-RMS
depending on distance from differential base station.
- Without differential corrections <5 meter 2D-RMS
(with S/A off)

Time to first fix:

- Cold start (no almanac or RTCM): 60 second (typical)
- Reacquisition <10 second (typical)

Antenna Input Impedance: 50 Ohms

Antenna type: MGL-3 Combo GPS/Beacon

Communications

Serial Ports: 2 duplex NMEA Ports

Baud Rate: 4800 baud (default), 9600 & 19200 (optional)

Data I/O Protocol: NMEA 0183 V3.0

RTCM Input: RTCM SC-104 format

Datum: WGS84

Output messages: GGA, GSA, GSV, GST, RMC, VTG, GRS,
ZDA, & (PMVXG,GBS)

Beacon Receiver

Frequency: 283.5 to 325.0 kHz. 2-channel Auto or
Manual selection (500 Hz steps)

Sensitivity: 2.5 μ V/m for 6dB SNR @ 200 bps

Station Selection: Automatic, Database or Manual

Dynamic Range: 100 dB

Adjacent Channel Rejection: 61 dB @ $f \pm 400$ Hz

Channel spacing: 500 Hz

Frequency offset tolerance: ± 5 Hz
Antenna type: H-Field
MSK rates: 50, 100 and 200 bps

Environmental

MX525A Console

Operating Temperature: -30 to +55 °C
Storage Temperature: -40 to +85 °C
Humidity: 95% non-condensing, protected category

MGL-3 Antenna

Operating Temperature: -30 to +70 °C
Storage Temperature: -40 to +85 °C
Splashproof: "Exposed Category" (IEC 60945)

Electrical

MX525A Console

Operating Voltage: 10.5 to 32 VDC
Reverse Polarity Protection: Yes
Operating current: < 230 mA at 12.0 VDC,
Power Consumption: <3 Watts
Antenna Supply Voltage: 5 VDC (100 mA max.)
Interface Cable: 3-meters, 10-wire Shielded Twisted Pair

MGL-3 Antenna

Operating Voltage: 5 to 12 VDC
Power Consumption: <1 Watt

Mechanical

MX525A Console

Dimensions: 13.5 (L) x 11.4 (W) x 3.7 (H) cm.
Weigh: 800 grams (1.7 lb.) (without cable)
Mount: U-Bracket (provided)

Power/Data Connector: ..3-meter, 10-wire Shielded Twisted Pair
Antenna Connector: TNC (female)

MGL-3

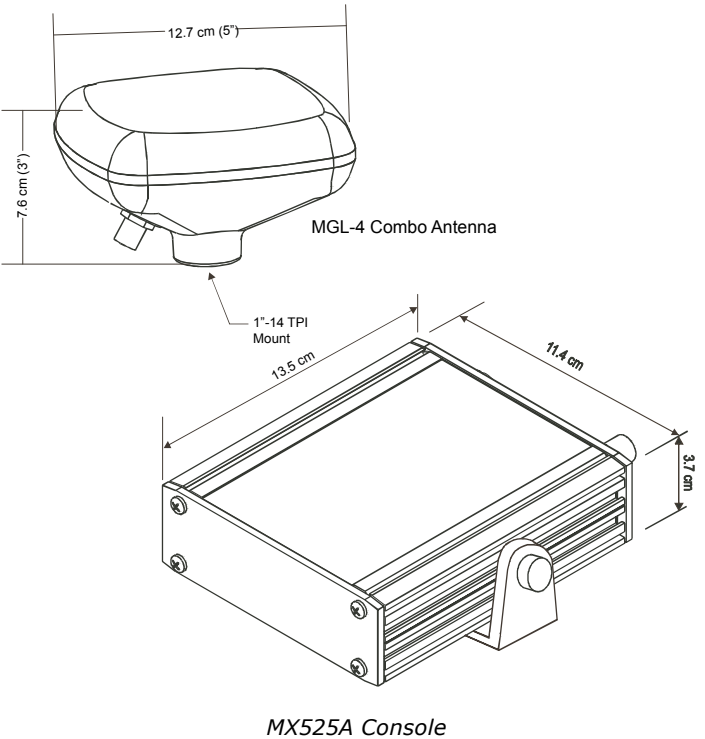
Dimensions: 12.7 cm (L) x 12.7 cm. (W) x 7.6 cm. (H)
Weight:460 grams (1.0 lb.)
Antenna Connector: TNC (female)
Mount: 1 in.- 14 TPI

Certifications

BSH and Wheelmark IMO MSC 112(73) approved
IEC 60945 ed.3, CE, and FCC compliant



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5 Data Output

The MX525A data output conforms to the NMEA 0183 V3.0 at 4800 baud. Below is a list of the NMEA sentences output:

NMEA 0183 V3.0: GGA, GLL, GSA, GSV, GST, RMC and VTG

NMEA 0183 Data Output Sentences

(1) **GGA** - Global Positioning System Fix Data

Time, position and fix related data for a GPS receiver.

\$GPGGA,hhmmss,llll.llll,a,yyyy.yyyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Notes: 1 ----- UTC of position

2,3 --- Latitude - N/S

4,5 --- Longitude - E/W

6 ----- GPS Quality Indicator:

0 = Fix not available or invalid

1 = GPS SPS Mode, fix valid

2 = Differential GPS, SPS Mode, fix valid

3 = GPS PPS Mode, fix valid

7 ----- Number of Satellites in use, 00-12, may be different from the number in view

8 ----- Horizontal Dilution of Precision (HDOP)

9 ---- Antenna altitude/mean-sea-level (geoid)

10---- Units of antenna altitude, Meters

11,12- Geoidal Height, Meters

13---- Age of Differential GPS Data

14 --- Differential Reference Station ID

(2) **GLL** - Geographic Position - Latitude/Longitude

Latitude and Longitude of vessel position, time of position fix and status.

\$GPGLL,IIII.IIII,a,yyyyy.yyyy,a,hhmmss.ss,A,a*hh<CR><LF>

1	2	3	4	5	6
---	---	---	---	---	---

Notes:

1,2 ----- Latitude, N/S

3, 4 -----Longitude, E/W

5 -----UTC of position

6 -----Position system Mode Indicator:

A=Autonomous mode

D=Differential mode

E=Estimated (DR) mode

M=Manual input mode

S=Simulator mode

N=Data not valid

(3) **GSA** - GPS DOP and Active Satellites

GPS receiver operating mode, satellites used in the navigation solution reported by the \$GPGGA sentence, and DOP values.

\$GPGSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x,x,x,x,x*hh<CR><LF>

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----

Notes: 1---- Mode: M = Manual, forced to operate in 2D or 3D Mode

A = Automatic, allowed to automatically switch 2D/3D

2 ---- Mode: 1 = Fix not available, 2 = 2D, 3 = 3D

3-14 -PRN numbers of satellites used in solution (null for unused fields)

15 ---PDOP

16 ---HDOP

17 ---VDOP

(4) **GSV** - GPS Satellite in View

Number of satellites (SV) in view, PRN numbers, elevation, azimuth and SNR values. Four satellites maximum per transmission, additional satellite data sent in second or third message. Total number of messages being transmitted and the number of the message transmitted are indicated in the first two fields.

\$GPGSV,x,x,xx,xx,xx,xxx,xx,.....,xx,xx,xxx,xx*hh<CR><LF>

T	T	T	T	T	T	T	T	T	T	T	T	T
1	2	3	4	5	6	7	8	9	10	11	12	

Notes: 1 -----Total number of messages, 1 to 3

2 ---- Message number, 1 to 3

3 ---- Total number of satellites in view

4 ----- Satellite PRN number

5 ----- Elevation, degrees, 90 degrees maximum

6 -----Azimuth, degrees True, 000 to 359

7 -----SNR (C/No) 00-99 dB, null when not tracking

8 -----2nd and 3rd SV

9,10,11,12 - 4th SV

(5) **RMC** - Recommended Minimum Specific GPS Data

Time, date, position, course and speed data provided by a GPS navigation receiver. This sentence is transmitted at intervals not exceeding 2 seconds. All data fields must be provided: null fields used only when data is temporarily unavailable.

\$GPRMC,hhmmss.ss,A,llll.llll,a,yyyyy.yyyy,a,x.x,x.x,xxxxxx,x.x,a*hh<CR><LF>

T	T	T	T	T	T	T	T	T	T	T	T	T
1	2	3	4	5	6	7	8	9	10	11		

Notes: 1 ---- UTC of Position fix

2 ---- Status: A = data valid

V = Navigation receiver warning

- 3,4 -- Latitude, N/S
- 5,6 -- Longitude, E/W
- 7 ---- Speed over ground, knots
- 8 ---- Course Over Ground, True
- 9 ---- Date: dd/mm/yy
- 10,11 - Magnetic variation, degrees E/W.
Easterly variation (E) subtracts from
True course, Westerly variation (W) adds
to True course.

(6) **GST** - GNSS Pseudorange Error Statistics

This message is used to support Receiver Autonomous Integrity Monitoring (RAIM). Pseudorange measurement error statistics can be translated in the position domain in order to give statistical measures of the quality of the position solution.

If only GPS, GLONASS, etc. is used for the reported position solution, the talker ID is GP, GL, etc., and the error data pertains to the individual system. If satellites from multiple systems are used to obtain the reported position solution, the talker ID is GN and the errors pertain to the combined solution.

\$GPGST,hhmmss.ss,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh<CR><LF>

1	2	3	4	5	6	7	8

- Notes:
- 1 ---- UTC time of the GGA or GNS fix associated with this sentence.
 - 2 ---- RMS value of the standard deviation of the range inputs to the navigation process.
Range inputs include pseudoranges & DGNSS corrections.
 - 3 ---- Standard deviation of semi-major axis of error ellipse (meters)
 - 4 ---- Standard deviation of semi-minor axis of error ellipse (meters)
 - 5 ---- Orientation of semi-major axis of error ellipse (degrees from true north)

- 6 ---- Standard deviation of latitude error (meters)
- 7 ---- Standard deviation of longitude error (meters)
- 8 ---- Standard deviation of altitude error (meters)

(7) **VTG** - Course Over Ground and Ground Speed

The actual course and speed relative to the ground.

```
$GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>
  T T T T T T T T T
  1 2 3 4 5 6 7 8 9
```

- Notes:
- 1,2 ---- Course over ground, degrees True
 - 2,3 ---- Course over ground, degrees Magnetic
 - 5,6 ---- Speed over ground, knots
 - 7,8 ---- Speed over ground, km/hr
 - 9 ----- Mode indicator: A = Autonomous mode
D = Differential mode
E = Estimated (DR)
M = Manual input mode
S = Simulator mode
N = Data not valid

(8) **ZDA** -Time and Date

UTC, day, month, year and local time zone

```
$GPZDA,hhmmss,xx,xx,xxxx,xx,xx*hh<CR><LF>
  T T T T T T
  1 2 3 4 5 6
```

- Notes:
- 1 --- UTC
 - 2, 3, 4 --- Day, month & year
 - 5 --- Local zone hours, 00 to \pm 13 hrs.
 - 6 --- Local zone in minutes, 00 to +59.

(9) **GBS** - GNSS Satellite Fault Detection (Modified MX version)

This message is used to support Receiver Autonomous Integrity Monitoring (RAIM) feature in the MX420 CDU. A special character flag was added for proper RAIM status determination.

\$PMVXG,GBS,hhmmss.ss,x.x,x.x,x.x,xx,x.x,x.x,x.x,x*hh<CR><LF>

1	2	3	4	5	6	7	8	9

- Notes:
- 1 ----- UTC time of the GGA or GNS fix associated with this sentence.
 - 2 ----- Expected error in Latitude (meters)
 - 3 ----- Expected error in Longitude (meters)
 - 4 ----- Expected error in Altitude (meters)
 - 5 ----- ID number of most likely failed satellite
 - 6 ----- Probability of missed detection for most likely failed satellite
 - 7 ----- Estimate of bias in meters on most likely failed satellite
 - 8 ----- Standard deviation of bias estimate
 - 9 ----- RAIM status mode; 0=safe, 1=caution, 2=unsafe

How are we doing?

Please help us to help you and our other valued customers by sending us your evaluation of this manual. We need to know such things as:

- is the manual complete, or do you need more (or less) information?
- can you find the information you need easily?
- is the information easy to understand, or could we be clearer?
- are there any errors and, if so, where and what are they?

Be sure to reference the title and identification number of this manual.

Please email your comments to: tech.writing@navico.com.

We look forward to finding out how we can improve our information services.

All of your comments and suggestions become the property of Navico Holding AS.

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